

How far have we come: 170 years of research on Canadian Coleoptera

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Abstract

A brief history of the research on Coleoptera in Canada is recounted. The Canadian fauna was first studied by Kirby (1837) from specimens collected during the first two Franklin expeditions to the Canadian Arctic. Over the next 170 years many investigators have turned their attention to Canadian beetles. In 1991, 7,436 species had been documented to occur in the country. Since then there have been many taxonomic, faunistic, ecological, and other studies. Despite this long history of research, it is evident that much still remains to be done. It is important to recognize that taxonomic research is the foundation for understanding the biological diversity of the natural world.

Keywords

Coleoptera, taxonomy, ecology, research, history, Canada

Beetles have long been a subject of interest and curiosity in Canada. A map of Halifax, Nova Scotia drawn by Moses Harris in 1749, the year of the settlement's foundation, illustrates "The Musk Beetle", an indeterminate species of longhorn beetle. In 1837, William Kirby (1759-1850), a British entomologist, published a compendium of insects collected in northern Canada by John Richardson, the naturalist on the first (1819-1822) and second (1825-1827) Arctic expeditions of Sir John Franklin. Also included were insects collected in the 1820's in Nova Scotia by Captain Basil Hall (a renowned explorer and author) and the Reverend Thomas McCulloch (the first president of Dalhousie University). Three hundred and thirty-one species of Coleoptera were treated, including many new species described by Kirby. Thomas Say (1787-1834), often called the "father of American entomology", published many papers on

Coleoptera. Subsequently, between 1844 and 1896, most families of North American beetles received initial treatments in publications by John Lawrence LeConte (1825-1883) and George Henry Horn (1840-1897). All three were entomologists from the United States, but many of the species they described were also found in Canada.

The Reverend Charles J.S. Bethune (1838-1932) played a key role in the development of Canadian entomology when in 1863, together with William Saunders (1809-1879), he co-founded the Entomological Society of Canada. For 30 years Bethune served as the editor of *The Canadian Entomologist*, a pioneering journal that published, and continues to publish, many valuable studies about Canadian Coleoptera. Philip H. Gosse (1840) pioneered the study of Coleoptera in the province of Québec (then known as Lower Canada). In the late 19th and early 20th century many more entomologists turned their attention to Coleoptera. Gustave Chagnon, W.J. Brown, William Couper, William S. M. D'Urbain, J.D. Evans, R.P. Gorham, W. Hague Harrington, J. Matthew Jones, William McIntosh, A.S. Packard, l'abbé Léon Provancher (founder of the *Le Naturaliste canadien*), and H. F. Wickham are just some of the entomologists who made important contributions to the study of Coleoptera during this era.

In the history of Canadian Coleoptera, Carl H. Lindroth (1905-1979) deserves special mention. A Swedish researcher at the University of Lund, Lindroth's (1961-1969) sixpart series on the ground beetles (Carabidae) of Canada and Alaska set a standard for excellence in scholarship that subsequent authors have worked to emulate. Lindroth was also a seminal figure in the study of the zoogeography of the northern hemisphere and volumes such as Lindroth (1955, 1957, 1963) were major contributions to this discipline. Other important contributions during this era were Chagnon (1940) on the fauna of Québec and Hatch (1953-1971), a five-part series on the beetles of the Pacific Northwest, which included the fauna of British Columbia.

The creation of the Biosystematic Research Institute and the Canadian National Collection of Insects, Arachnids, and Nematodes (CNC) had profound impacts on Coleoptera research in the country. The CNC was formed between 1914 and 1918 by the amalgamation of the collections of the Biological Division of the Geological Survey, Department of Mines, and that of the Entomological Branch of the Department of Agriculture (Ruelle 1970). The CNC Coleoptera collection is global in its coverage but has an extensive coverage of Canadian material and now contains approximately 2 million specimens. This institution created a critical mass of insect taxonomists who contributed to rapid growth of the collection and of collections-based research. It has been and continues to be a major contributor to the inventory of Canadian fauna. Under the stewardship of this Institute (now within Agriculture and Agri-Food Canada, Biodiversity, Systematic Entomology), many important works on Canadian beetles were published by E. Becker, D. Bright, W.J. Brown, J.M. Campbell, H.F. Howden, and A. Smetana, and later Y. Bousquet, A. Goulet, L. LeSage, and recently P. Bouchard. The second author started his career there in 1973 and later continued in 1980-1982 as a postdoctoral fellow.

In this regard the efforts of the late Edward Becker deserve special mention. A taxonomist who specialized in the Elateridae, Becker was also an editor of the *Coleopterist's Bulletin* (1983-1990) and president of the Coleopterist's Society (1971-1972).

However, perhaps his greatest contribution to entomology was through the CanaColl Foundation, a non-profit organization that Ed helped create and almost single-handedly nurtured for the past 36 years. The foundation promotes taxonomic research at CNC by providing funds to visiting entomologists who curate the collection.

This 140-year history of studies was summarized by Campbell et al. (1978) who reported that 6,742 species of beetles were then known in Canada, further estimating that 2,368 additional species were unreported or undescribed in the country. Despite this, Campbell et al. (1978) noted that the only comprehensive treatments of beetles in Canada were Lindroth's work on Carabidae, Bright (1976) on the Scolytinae, and Barron (1971) on the Trogositidae. This summary actually understated the research which had been conducted since investigators such as John Milton Campbell (1973, 1976) had revised *Tachinus* and *Sepidophilus* (Staphylinidae) in North and Central America; Edward C. Becker (1971, 1974) had revised the Nearctic species of *Agriotes* and *Athous* (Elateridae); W.J. Brown (1934, 1935a, 1935b, 1935c, 1936a, 1936b, 1936c, 1936d) had revised the genus *Dalopius* and substantial portions of the genus *Ctenicera* (*sensu lato*), then known as *Ludius* (Elateridae); Ales Smetana (1971) had revised the Que-diini (Staphylinidae) in North America; Henry F. Howden (1964, 1968) had revised the Geotrupidae and the Trichiinae of North and Central America; J.B. Wallis (1961) had surveyed the Cicindelinae of Canada; and A.R. Brooks (1960) had delineated the elaterid fauna of southern Alberta, Saskatchewan, and Manitoba.

Campbell et al. (1978) was an important benchmark, however, and perhaps spurred by their call that "future students and workers should be encouraged to undertake faunal studies of neglected families or subfamilies of beetles for all of Canada or all of North America", the following dozen years saw an explosion of interest in Canadian Coleoptera. Smetana (1982, 1985, 1988, 1995) revised the Xantholinini (Staphylinidae), Helophorinae, Hydrophilidae, and Philonthina (Staphylinidae); Campbell (1979, 1982, 1991) continued his work on the staphylinids with important revisions of *Tachyporus*, *Lordithon*, and *Mycetoporus*; Donald Bright (1981, 1987) reviewed the complicated bark-beetle genus *Pityophthorus*, and the Canadian Buprestidae; Robert S. Anderson and Stewart Peck (1985) reviewed the Canadian Silphidae and Agyrtidae; Jan Klimaszewski (1979, 1984) revised the Gymnusini, Deinopsini, and the genus *Aleochara* (Staphylinidae: Aleocharinae); Laurent LeSage (1986) revised *Ophraella* (Chrysomelidae); and there were many other revisions of individual genera.

In 1991 when the Checklist of Beetles of Canada and Alaska (Bousquet 1991) was published, the Canadian fauna was listed as 7,436 species, an increase of 694 in a span of 13 years. Since that time, the pace of work in Canada has continued to increase. Many additional families, subfamilies, tribes, and genera have been revised, and there have been a large number of faunistic studies and regional treatments. Bright (1993) treated the Anthribidae, Nemonychidae, Brentidae, Apionidae, Ithyceridae, Attelabidae, and Platypodidae of Canada and Alaska. Larson et al. (2000) comprehensively surveyed the Dytiscidae of North America, focusing particularly on the Canadian fauna. Pearson et al. (2006) and Leonard and Bell (1999) published important guides to North American tiger beetles (Cicindelinae) while Acorn (2001, 2007) wrote field

guides to the Alberta Cicindelinae and Coccinellidae. Bousquet and Laplante (2006) revised the Histeridae of Canada and Alaska, Gouix and Klimaszewski (2007) compiled a catalogue of the Canadian Aleocharinae which was preceded by numerous generic revisions of aleocharine genera (Klimaszewski et al. 2001, 2002, 2003, 2004, 2006a,b, Klimaszewski and Pelletier 2004, Maruyama and Klimaszewski 2004a,b, 2006), and recently Bright and Bouchard (2008) published a fauna and revision of the Entiminae (Curculionidae) of Canada and Alaska.

Following the trail blazed by Lindroth, George Ball and Yves Bousquet have published many studies of the North American Carabidae, not least of which being their chapter on this family in *American Beetles* (2000). George Ball, an academic at the University of Alberta, with his extensive knowledge, energy, dedication, and magnetic personality has had an enormous impact on studies on Canadian and world Carabidae and other Coleoptera, as well as on the education of entire generations of Canadian and American Coleopterists. Some most prominent among them are Terry Erwin, David Kavanaugh, Henri Goulet, J. Steve Ashe, and many others. Stewart Peck, who specializes in the Leiodidae and in cave faunas has made extensive contributions to the knowledge of these groups; and Henry Howden, a former colleague at Carleton University, now working through the Canadian Museum of Nature, is one of the world's foremost authorities on the Scarabaeidae. Together with Robert Anderson and colleagues they have helped make the Canadian Museum of Nature a major national and international institution in the study of Coleoptera.

Robert Roughley (2000a, 2000b, 2000c) has comprehensively surveyed the Canadian water beetle fauna, contributing three chapters on the Gyrinidae, Haliplidae, and Noteridae, for *American Beetles* and collaborating with David Larson on the Dytiscidae (2000). Canadian entomologist Darren Pollock has made extensive contributions to the knowledge of saproxylic beetles, writing chapters on the Tetratomidae, Melandryidae, Mycteridae, Boridae, Pythidae, Salpingidae, and Scraptidae for the second volume of *American Beetles* (2002a, 2002b, 2002c, 2002d, 2002e, 2002f; Young and Pollock 2002); and Robert Anderson has revised many groups of Canadian and North American weevils and contributed chapters on the Nemonychidae, Brentidae, Ithyceridae, and Curculionidae to the second volume of *American Beetles* (2002a, 2002b, 2002c; Anderson and Kissinger 2002). Many other studies have been published, some dealing with aspects of the Canadian fauna, others examining the Nearctic fauna as a whole.

In addition to taxonomic and faunistic works, many ecological studies have started to appear, particularly in the past couple of decades. An important focus of interest, given the extensive forested areas of Canada, have been saproxylic beetles and the role that they play in forest dynamics and ecology. Studies by James Hammond, David Langor, Greg Pohl, and John Spence in Alberta and their colleagues and associates, have drawn important attention to this functional group of insects. Larochelle and Larivière (2003) published a comprehensive natural history of the Carabidae of North America. Canada also has an extensive coastline and there has been a recent interest in coastal and island faunas. Since publications by Brown (1940) and Lindroth (1957), there has also been a very considerable interest in adventive species in Canada, on both

the Atlantic and Pacific coasts, and many recent studies have focused on documenting the large spectrum of introduced species found in the country.

However, despite this long history of observation, investigation, and scholarship, many of us involved in the field feel we have only begun to scratch the surface. For every question that has been answered there appear to be a dozen that require investigation. The more we learn about a species, the more we realize there are a host of taxonomic, behavioral, physiological, developmental, zoogeographic, evolutionary, historical, and ecological dimensions that we know little or nothing about.

The papers compiled in this volume are an illustration of how much still remains to be discerned. Many groups still require taxonomic revision and species need to be described. Basic parameters of the distribution, dispersal, zoogeographic status, phenology, and bionomics of many species have yet to be understood. There are many Canadian beetles whose bionomics have never been investigated or whose distribution is almost completely unknown. New historical timelines of adventive species are continually being discovered. Furthermore, the synecological dimensions of communities of beetles within habitats like forests are just starting to receive attention in Canada. Details of how they contribute to nutrient, energy, and carbon cycling in forests, and interact with communities of predators and prey, are key in understanding the ecological dynamics of forests. There are similar interests in relation to the beetle communities of lakes, rivers, seashores, fields, bogs, marshes, and other habitats in which beetles are important ecological components.

The answers to these questions are not only of interest for academic reasons, but for economic and environmental ones as well. Many beetles play prominent roles in forestry and agricultural settings, sometimes as beneficial species, at other times as “pests”. Invasive species are a cause of considerable concern in Canada, and comprehensive faunal inventories and ongoing monitoring are important in safeguarding our environment from “bio-invaders”. In an era when there are concerns relating to pollution and climate change, an interest in using Coleoptera as bio-indicators of ecological change has developed. Beetles are widespread, numerous, species-rich, and easily sampled. They exhibit greater site specificity than vertebrates, and respond to environmental changes more rapidly than vascular plants or vertebrates. For all these reasons it behooves us to continue to develop our knowledge of this important group of invertebrates.

In compiling this volume, in part a celebration of the launch of ZooKeys – an important new venue for scientific research that embraces excellence, diversity, and inclusiveness, and reaches out to the scientific community with its policy of open electronic access – we must express our thanks to many people. First of all, to the many authors who responded to our requests to contribute their work to this volume. Also to the many coleopterists, who for reasons of timing or other commitments, were unable to participate, but who nonetheless expressed their support and wished us well in the venture. Thanks also to Pamela Cheers for her attentive copy editing. And finally to Lyubomir Penev, Terry Erwin, and their entire editorial team at ZooKeys. Their vision and commitment in launching the journal, their infectious energy, enthusiastic support, constantly helpful ideas, tireless energy, and the trust they extended to us in this venture were outstanding. For all this, we express our warmest thanks.

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